REMARKS

The Examiner's Office Action of August 23, 2005 has been received and its contents reviewed. Applicants would like to thank the Examiner for the consideration given to the above-identified application, for conducting a personal interview with Applicants' representative on December 20, 2005, and for suggesting amending claim 6 to incorporate the features of original claim 10 to further distinguish the claimed invention over U.S. Patent No. 5,650,340 to Burr et al.

Filed concurrently herewith is a *Request for a One Month Extension of Time* which extends the shortened statutory period of response to December 23, 2005. Accordingly, Applicants respectfully submit that this response is being timely filed.

Claims 1-10, 12, 15, 21, 23 and 24 were pending prior to the instant amendment. Claims 1-5 have been withdrawn from consideration. By this Amendment, claims 6 and 24 have been amended, and claim 10 has been cancelled.

Referring now to the detailed Office Action, claims 6-10, 12, 21, 23 and 24 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Burr et al. (U.S. Patent No. 5,650,340 – hereafter Burr), in view of Richards, Jr. et al. (U.S. Patent No. 5,789,620 – hereafter Richard, Jr.) and Sultran (U.S. Patent No. 5,970,353 – hereafter Sultran) - all of record. Further, claims stands is rejected under 35 U.S.C. §103(a) as being unpatentable over Burr, Richards and Sultan, and further in view of Tsukamoto (U.S. Patent No. 5,399,506 – hereafter Tsukamoto - of record). These rejections are respectfully traversed at least for the reasons provided below.

Initially, in the interest of expediting the allowance of this case, Applicants have amended independent claim 6, as shown above, to incorporate the features of original claim 10, as suggested by the Examiner. The Examiner stated that Burr teaches a well but not a channel. Hence, as amended, claim 6, as well as its dependent claims, distinguishes over Burr, and the pending claims are placed in condition for allowance.

Although the pending claims are now in condition for allowance by the amendment of claim 6 above, Applicants do not agree with the Examiner's rejections and would like to traverse the rejections for the record. Further, Applicants reserve the right to file a divisional application to claim the subject matter in claim 6 prior to being amended above and in the withdrawn claims.

Applicants respectfully assert that Burr teaches an asymmetric device with a halo

(i.e., "pocket dopant diffused region") implanted on the source **or** drain side of the device, as disclosed in the Abstract, for example, of Burr. Further, the asymmetric device is desirable over a symmetric device for a number of improved electrical characteristics, as disclosed in col. 7, lines 31-32, and col. 7, line 58 through col. 8, line 4, for example, of Burr.

Moreover, Burr recognizes that symmetric devices with halo implants beneath the areas underlying the source and drain edges (col. 2, lines 19-27) are known for reducing punch through. However, Burr recognizes that symmetric devices have short comings (see, e.g., col. 7, lines 31-32, and col. 7, line 58 through col. 8, line 4) and hence the reason for creating the low threshold voltage MOS devices having asymmetric halo implants of Burr.

At least for the reasons set forth above, Burr does not teach, disclose or suggest having a halo implanted on both sides of the gate electrode, Burr cannot be combined with other cited references so as to change the asymmetric devices of Burr into symmetric devices with halo implants on both sides of a gate electrode because having a halo implanted on both sides of the electrode would deviate from the intend desirable effects of the asymmetric halo implants of Burr.

Further, the Examiner asserted in the Office Action that Burr discloses forming an amorphous layer and a dislocation loop layer as well as indium ion implantation. However, such disclosure cannot be found anywhere in Burr. Applicants respectfully submit that the only disclosure of "indium" in Burr is in the paragraph shown below:

> *Next, as shown in FIG. 4G, a mask 126 is formed over one side of the active region. Thereafter a p-type dopant implant is conducted at an energy and dosage sufficient to form an asymmetric pocket region 116. For example, the asymmetric halo implant might be conducted with boron implanted at about $5x10^{12}$ to $5x10^{13}/cm^2$ at an energy of between about 50 and 70 keV. In some embodiments,* ***indium*** *may be an appropriate dopant for NFETs and antimony may be an appropriate dopant for PFETs because these elements have relatively small diffusion coefficients and therefore are likely to form pockets having steeper concentration profiles.*

Hence, the basis on which the Examiner stands when making the above assertion is not clear. If the Examiner only relies on the dose of 5 x $10^{13}/cm^2$ in the Burr patent to make the above assertion, the Examiner is respectfully request to explain what the figure represents. The figure of 5 x $10^3/cm^2$ represents an upper limit of the dose ranging from 5 x $10^{12}/cm^2$ to 5 x $10^{13}/cm^2$, within which no amorphous layer is formed. Applicants respectfully assert that, base on the disclosure of Burr, there is not any intention to form the

amorphous layer and the dislocation loop layer by performing implantation of indium ion at the dose of $5 \times 10^{13}/cm^2$.

Further, the Examiner alleged, in page 3, last paragraph, of the Office Action, that Burr discloses that "the pocket dopant diffused layer (116) is formed having a peak dopant concentration produced by trapping heavy ions (B, In) in the dislocation loop layer, the pocket dopant diffused layer (116) and the extended high-concentration dopant diffused layer (131 A-B) are in contact at the peak dopant concentration of the pocket dopant diffused layer (116)...". However, Applicants respectfully assert that such disclosure cannot be found anywhere in the Burr patent. Again, it is not clear which part in the Burr patent the Examiner relies on to make the above assertion, and the Examiner is respectfully request to cite specific text in Burr that support the assertion.

Still further, the Examiner considers the regions 62 in Sultan as a pocket dopant diffusion layer. However, it is apparent from Fig. 14 that the regions 62 are not the pocket dopant diffusion layer. Applicants respectfully assert that, from a technical point of view, there is no benefit in applying the implant dose for the regions 62 of Sultan, which are not the pocket regions, to the pocket regions in the Burr patent.

Applicants respectfully submit that the method of fabricating the semiconductor device according to the present claim 6 is characterized in that:

(a) the indium ion implantation is performed at a dose of about $\underline{1 \times 10^{14} \text{ to } 1 \times 10^{16}/cm^2}$ to form an amorphous layer and a dislocation loop layer in a semiconductor region;

(b) a pocket dopant diffused layer is formed having a peak dopant concentration produced by trapping indium ions in the dislocation loop layer; and

(c) the pocket dopant diffused layer and an extended high-concentration dopant diffused layer are in contact at the peak dopant concentration of the pocket dopant diffused layer.

According to the above structure, an amorphous/crystalline interface is formed inside the semiconductor region after the indium ions are implanted at a dose of about 1×10^{14} to $1 \times 10^{16}/cm$. If the annealing process is conducted after this amorphous/crystalline interface has been formed, then the dislocation loop layer will be formed. At this time, a segregated part will be also created in the dislocation loop layer through segregation of indium. As a result, the dopant profile of the pocket dopant diffused layer does not expand vertically

deeper into the substrate but sharpens; and, therefore, the dopant profile of the pocket dopant diffused layer can have its junction defined at a shallower level.

The differences between Burr and the presently claimed invention are as follows:

In the Burr patent, based on the Examiner's assertion, the implant dose of the indium ions in the pocket region is 5 x $10^{12}/cm^2$ to 1 x $10^{13}/cm^2$, whereas in the present invention the implant dose of the indium ions is about 1 x $10^{14}/cm^2$ to 1 x $10^{16}/cm^2$. Applicants note that the Examiner acknowledged this difference.

Law cases have held that the specification need not necessarily disclose proportions or ranges in a composition claim as critical in order for them to be considered as such, *Jennings et al. V Brenner, Comr. Pats.* (DCDC 1966) 555 Fsupp 410, 150 USPQ 167; *Scandiamant Aktiebolag v. Comr Pats.* (CADC 174) 509 F2d 463, 184 USPQ 201; *In re Saunders et al.* (CCPA 1971) 444 F2d 599, 170 USPQ 213.

The Examiner asserted that "the claimed dose of about 1 x $10^{14/}cm^2$ to 1 x $10^{16}/cm^2$ does not appear to be critical. However, it is much critical to set the implant dose of the indium ions to be about 1 x $10^{14}/cm^2$ to 1 x $10^{16}/cm^2$ so that the pocket dopant diffused layer can have its junction at a shallower level. This is because, if the implant dose of the indium ions is less, the amorphous layer is not formed in the semiconductor region. If the amorphous layer is not formed, the dislocation loop layer is not also formed. As a result, it becomes impossible that the pocket dopant diffused layer has its junction at a shallower level.

On the other hand, in the Burr patent, the range of the implant dose of the alleged indium ions, that is, 5 x $10^{12}/cm^2$ to 5 x $10^{13}/cm^2$, is less than that of the present invention. When the implantation is performed at a dose of 5 x $10^{12}/cm^2$, for example, it is impossible to form the amorphous layer in the semiconductor region. The upper limit of the range (5 x $10^{13}/cm^2$) is the threshold between whether the amorphous layer would be formed in the semiconductor region or not. Therefore, Applicants respectfully assert that no amorphous layer is formed, if the implantation of the indium ions is performed at a dose ranging from 5 x $10^{12}/cm^2$ to 5 x $10^{13}/cm^2$ as disclosed in the Burr patent. Again, Applicants assert that Burr fails to teach, disclose or suggest the idea of forming the amorphous layer by implanting the indium ions.

Further, Burr also fails to disclose forming the dislocation loop layer by conducting the annealing process after the implantation of the indium ions. The Examiner insisted that it is disclosed in Burr. However, there is no specific text in the Burr patent that is cited by the

Examiner to support this assertion. Therefore, the Examiner's insistence is only an unsupportable allegation. Moreover, when forming the dislocation loop layer by performing the indium ion implantation then the annealing process, the amount of the indium ions is important. If the indium ions are implanted at a dose of less than 5 x $10^{13}/cm^2$, the amorphous layer and the dislocation loop layer are not formed. In contrast, Burr, wherein the range of the implant dose of the alleged indium ions is 5 x $10^{12}/cm^2$ to 5 x $10^{13}/cm^2$, merely discloses the amount of dose that does not form the amorphous layer. The dosage of 5 x $10^{13}/cm^2$ is the upper limit in the Burr patent, whereas it is the lower limit in the present invention.

In the previous response filed on August 8, 2005, Applicants amended claim 6 by deleting "more than 5 x $10^{13}/cm^2$ and adding about 1 x $10^{14}/cm^2$ to 1 x $10^{16}/cm^2$ to clarify the distinctions between Burr and the present invention. Applicants respectfully direct the Examiner's attention to MPEP §2164.08 (page 2100-197, Rev. 2, May 2004). It is stated therein that claims are interpreted in light of the specification does not mean that everything in the specification must be read into the claims.

The differences between Richards and the presently claimed invention are as follows:

Richards discloses forming the drain pocket implant 100 and the source pocket implant 102. However, Richards fails to disclose the condition under which the drain pocket implant 100 and the source pocket implant 102 are formed. Therefore the teachings of Burr and the teachings of Richards cannot be combined to obtain the present invention.

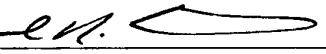
The differences between Sultan and the presently claimed invention are as follows:

Sultan discloses that the indium ions amorphize if implanted at a dose of 1 x $10^{14}/cm^2$. However, Sultan implants ions at a 10 to 30 percent dose of the amorphizing dose to form the interstitial regions 62. In other words, the interstitial regions 62 will be amorphized when the ion implantation dose is 1 x $10^{13}/cm^2$ to 3 x $10^{13}/cm^2$. Applicants respectfully assert that Sultan fails to disclose any region that corresponds to the pocket region in the presently claimed invention. The regions 62, referred to by the Examiner as the pocket dopant diffused layer, are the interstitial regions 62 formed inside the extension regions 66 and 67, but not the pocket dopant diffused layer. From a technical point of view, there is no benefit in applying the implant dose for the regions 62 of Sultan, which are not the pocket regions, to the pocket regions in the Burr patent. Therefore Burr and Sultan cannot be combined with each other to obtain the present invention.

As set forth above, none of the references discloses forming the amorphous layer by performing the indium ion implantation at a dose of 1 x $10^{14}/cm^2$ to 1 x $10^{16}/cm^2$ and forming the pocket dopant diffused layer having its junction at a shallower level by forming the dislocation loop layer through the annealing process. Moreover, none of the combination of the references anticipate the present invention as recited claim 6. Claims 7-10, 12, 15, 21, 23 and 24 are also distinguishable over the cited prior art references, since they are dependent from claim 6.

In view of the foregoing, it is respectfully requested that the rejections of record be reconsidered and withdrawn by the Examiner, that claims 6-9, 12, 21, 23 and 24 be allowed and that the application be passed to issue. If a conference would expedite prosecution of the instant application, the Examiner is hereby invited to telephone the undersigned to arrange such a conference.

Respectfully submitted,



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